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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/801,630	03/08/2001	Kars-Michiel Hubert Lenssen	NL 000094	8319

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EXAMINER	
DOLAN, JENNIFER M	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 02/27/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/801,630	LENSSEN, KARS-MICHIEL HUBERT	
	Examiner	Art Unit	
	Jennifer M. Dolan	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 November 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4 and 6-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 6-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-13 and 16 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 1, 13, and 16, it is unclear exactly what the applicant means by "furthermore *coupling the influencing* of said second structure on said first structure." For the purposes of examination, it is assumed that the second structure is simply magnetically coupled to the first structure.

Regarding claim 8, the applicant claims in independent claim 1 that the thickness of the high-resistive metallic material is less than 5 nm, but in dependent claim 12, it is claimed as 1 atomic layer-15 nm. Since the thickness range in the dependent claim is broader than that of the independent claim, it is unclear as to exactly what thickness range is being claimed.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-4, 6-9, and 12-16 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,023,395 to Dill et al.

Regarding claims 1, 6, 8, 12, and 13-16, Dill discloses a magnetic memory structure having a first structure of layers (116, 118, 120, 132) including at least a first ferromagnetic layer (118) and a second ferromagnetic layer (132) with at least a separation layer of a nonmagnetic material (120) therebetween (figure 4A); a second structure (150) including at least one magnetic layer (column 12, line 40 – column 13, line 45), the second structure influencing at least one intrinsic magnetic characteristic of the first structure (column 3, lines 28-40); and the second structure being separated from the first structure by at least a spacer of a high-resistive metallic material (152) which couples the second structure to the first without substantially influencing the magnitude of the magnetoresistance (column 3, lines 28-40) and is less than 5 nm thick (column 6, lines 19-22). Regarding claim 15, it is an inherent property of the sensor of Dill that 'a magnetoresistance characteristic *can* be tuned' by adjusting a thickness of the high-resistive metallic material (also see column 6, lines 14-24). Regarding claims 6 and 14, Dill discloses that the high-resistive metallic material can be Ta (column 6, lines 21-24), which inherently induces a crystallographic characteristic on layers deposited upon it, in this case, the second structure. Regarding claim 16, Dill discloses a first ferromagnetic layer structure with an even number of non-abutting ferromagnetic layers (118; see column 9, line 65 – column 10, line 5), and an odd number in the second structure (150).

Regarding claim 2, Dill discloses that the second structure includes a layer of high coercivity (column 6, lines 1-15).

Regarding claim 3, Dill discloses that the second structure includes a layer of exchange biasing material (column 13, lines 7-15).

Regarding claim 4, Dill discloses that the second structure comprises a layer with a magnetization antiparallel to the first ferromagnetic layer (figure 5B).

Regarding claims 7 and 9, Dill discloses that the spacer can be Cr or Ta (column 6, lines 14-25).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-4, 6-8, and 13-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,175,475 to Lin et al. in view of Dill et al.

Regarding claims 1, 13, and 15 Lin discloses a data storage system (column 1, lines 12 – 19) comprising a set of structures (figure 4) including: a first structure of layers (430, 420, 415, 410) including at least a first ferromagnetic layer (420) and a second ferromagnetic layer (410) with at least a separation layer of a non-magnetic material therebetween (415; figure 4), the first structure having at least a magnetoresistance effect (column 1, line 41 – column 2, line 3); a second structure (406 and 432) including at least one magnetic layer (406 and 432), the second structure influencing at least one intrinsic magnetic characteristic of the first structure (bias field/magnetic moment, column 2, lines 23-30; column 3, lines 15 – 27; column 6, lines 35-65);

and the second structure being separated from the first structure by at least a spacer layer (408), wherein the non-magnetic material is a metal (column 5, lines 12 – 14) and the spacer layer comprises a high-resistive metallic material (column 5, lines 17 – 23). Regarding claim 15, it is an inherent property of the sensor of Lin that 'a magnetoresistance characteristic *can* be tuned' by adjusting a thickness of the high-resistive metallic material.

Lin teaches that the spacer layer thickness is "about 50 angstroms" (see column 5, lines 15-20), which is considered to encompass a range of slightly less than 50 angstroms to slightly more than 50 angstroms, and thus intersects the range of less than 50 angstroms claimed by the applicant. Assuming arguendo, Lin does not explicitly teach that the spacer can have a thickness of less than 50 angstroms.

Dill teaches a magnetoresistive device with a flux keepered configuration substantially similar to that of Lin. Dill further teaches that the spacer layer can be made as thin as 2 nm, in order to balance the ferromagnetic coupling and magnetostatic coupling between the two layers (see column 3, lines 25-45; column 6, lines 15-25).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify that the spacer layer of Lin could be less than 50 angstroms, as taught by Dill, because such a thickness is appropriate for a flux-keepered configuration for stabilizing the magnetic moment and linearizing the output of the device.

Regarding claim 2, Lin discloses that the second structure comprises at least one layer (432) of a magnetic material of a high coercivity.

Regarding claim 3, Lin discloses that the second structure comprises at least one layer (432) of an exchange biasing material.

Regarding claim 4, Lin discloses that the second structure comprises a layer (406, 432) that has a magnetization direction that is substantially anti-parallel with respect to the magnetization direction of the first ferromagnetic layer (column 3, lines 15 – 18).

Regarding claims 6 and 14, Lin discloses that the high-resistive metallic material is Ta (column 5, lines 17-18), which inherently induces a crystallographic characteristic on layers deposited upon it (column 4, lines 63 – 67), in this case, the second structure.

Regarding claim 7, Lin discloses that the high resistive metallic material is Ta (column 5, lines 17 – 18).

Regarding claim 8, Lin discloses that the high-resistive metallic material has a thickness of 5 nm (column 5, lines 16 – 19), which is in the range of one atomic layer up to 15 nm.

7. Claim 16 is rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No 6,127,053 to Lin et al.

Lin discloses a magnetic system such as a data storage system or a sensing system of a magnetic characteristic (column 1, lines 8 – 11), the system comprising a set of structures (figure 8) including: a first structure of layers including at least a first ferromagnetic layer structure (420) and a second ferromagnetic layer (410) with at least a separation layer of a non-magnetic material therebetween (415), the first structure having at least a magnetoresistance effect (column 1, line 53 – column 2, line 13); a second structure including at least one magnetic layer (406), the second structure influencing at least one intrinsic magnetic characteristic of the first structure (column 2, lines 19 – 29); the second structure being separated from the first structure by at least a spacer layer (408) of a high-resistivity metallic material (column 7, lines 26 – 27)

furthermore influencing the coupling of the second structure on the first structure while not substantially influencing the magnitude of the magnetoresistance effect of the first structure (column 6, lines 39 – 50; column 2, lines 19-29; also, it is inherently the case that the second structure will not substantially influence the MR effect of the first structure, since the Ta spacer only allows the second structure to weakly couple to the first structure). Lin further discloses that the first ferromagnetic layer structure can comprise 2 non-abutting ferromagnetic layers (column 11, lines 60 – 61 and figure 7b and 8), while the second structure comprises 1 ferromagnetic layer (406). Thus, Lin discloses that the first ferromagnetic layer structure and second structure respectively comprise an even number of non-abutting ferromagnetic layers and an odd number of non-abutting ferromagnetic layers.

Lin teaches that the spacer layer thickness is "about 50 angstroms" (see column 7, lines 25-30), which is considered to encompass a range of slightly less than 50 angstroms to slightly more than 50 angstroms, and thus intersects the range of less than 50 angstroms claimed by the applicant. Assuming arguendo, Lin does not explicitly teach that the spacer can have a thickness of less than 50 angstroms.

Dill teaches a magnetoresistive device with a flux keepered configuration substantially similar to that of Lin. Dill further teaches that the spacer layer can be made as thin as 2 nm, in order to balance the ferromagnetic coupling and magnetostatic coupling between the two layers (see column 3, lines 25-45; column 6, lines 15-25).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify that the spacer layer of Lin could be less than 50 angstroms, as taught by

Dill, because such a thickness is appropriate for a flux-keepered configuration for stabilizing the magnetic moment and linearizing the output of the device.

8. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al. '475 in view of U.S. Patent No. 6,166,539 to Dahlberg et al.

Lin discloses that the layer of high-resistive material is made of Ta, Al_2O_3 or SiO_2 (column 5, lines 17 – 18 and column 6, lines 26 – 28).

Lin fails to disclose a metallic polymer with a conductivity in the range of the conductivities of the group of Ti, Zr, Hf, etc.

Dahlberg discloses that polyimide can be used in place of Al_2O_3 or SiO_2 in a magnetic head (column 16, lines 42 – 43).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to replace the layer of high-resistive material of Lin with a polymer, as taught by Dahlberg. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to substitute the polymer for the high-resistive material, because Dahlberg shows that they can be used interchangeably.

9. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al. '475 in view of U.S. Patent No. 6,178,072 to Gill.

Lin discloses that the second structure is separated from the first structure by a layer selected from a group including high-resistive metallic materials (Ta) and insulating layers (Al_2O_3, SiO_2) (column 5, lines 17 – 18 and column 6, lines 26 – 28).

Lin fails to disclose that the spacer comprises a layer of a high-resistive metallic material and an insulating layer abutting the high-resistive layer.

Gill discloses a spacer comprising a layer of high-resistive metallic material (308) and an insulating layer (306) abutting the layer of high-resistive metallic material.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the magnetoresistive structure of Lin, so that the spacer includes the high-resistivity material abutting an insulating layer, as taught by Gill. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide an insulating layer abutting a high-resistivity layer, in order to prevent shunting of the magnetoresistive sense current of the first structure through the second structure. This allows the second structure to be designed in such a way that read signal symmetry and greater thermal stability are achieved (Gill, column 3, lines 15 – 24).

10. Claims 9 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al. '475 in view of U.S. Patent No. 6,114,719 to Dill et al.

Regarding claim 9, Lin discloses a spacer layer made of a Ta, which is a high-resistive metallic material (column 5, lines 17 – 18).

Lin fails to disclose that the high-resistive metallic material is made of Cr, Mo, or W.

Dill discloses a nonmagnetic spacer layer made of Cr (column 7, lines 4-8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the spacer layer of Lin so that it is made of Cr, as taught by Dill. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would

have been motivated to use Cr for the spacer layer, since it is a recognized art equivalent to Ta as a nonmagnetic high-resistivity spacer material (Dill, column 7, lines 5-7), and thus Cr and Ta can be used interchangeably in this capacity.

Regarding claim 12, Lin teaches a magnetoresistive read sensor, but fails to disclose a magnetic memory structure.

Dill discloses a magnetic memory structure (column 1, lines 45 – 50).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the magnetoresistive structure of Lin so that it can be used in memory structures, as taught by Dill. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to use the magnetoresistive structure in a memory structure, because equivalent structures can be used for both solid state memory and external magnetic field read sensors (Dill, column 1, lines 45 – 50). Thus, it is well within the purview of a person having ordinary skill in the art to use a magnetoresistive sensing structure in either a memory structure or a magnetoresistive read head.

Response to Arguments

11. Applicant's arguments filed 11/21/03 have been fully considered but they are not persuasive.

The Applicant first argues that Lin '475 does not teach that the second structure influences a magnetoresistance characteristic of the first structure. This is not persuasive, because Lin explicitly discloses several magnetoresistance characteristics of the first layer structure, such as demagnetizing fields, magnetostatic coupling to the free layer, and MR

sensitivity, that are influenced by the second structure (see Lin '475; column 2, lines 23-30; column 3, lines 15 – 27; column 6, lines 35-65). The remainder of the Applicant's arguments are moot in view of the new grounds of rejection.

Insofar as it is noted that the Applicant has removed the requirement that the second structure be mainly ferromagnetically coupled to the first structure via amendment, the issue of whether Lin '475 includes "orange peel" ferromagnetic coupling is moot. In the event that this requirement should be re-added to the claims, the Examiner would like to clarify the argument that Lin must inherently have this "orange peel" coupling.

Insofar as it is understood in the art, microwaviness is expected when any metallic material is deposited under conventional means. Ferromagnetic "orange-peel" coupling is expected when two ferromagnetic metallic layers are separated by a very thin high-resistivity layer (for example, 5 nm of Ta) unless steps are taken to smooth the ferromagnetic layer and remove the microwaviness from the ferromagnetic layers (see U.S. Patent Publication No. 2003/0021908 to Nickel et al. particularly paragraphs 0007-0019, and U.S. Patent No. 6,292,389 to Chen, columns 1 and 2). Since neither Lin '475 nor the applicant disclose any steps taken to either remove or enhance the microwaviness of the ferromagnetic layers, since both disclose the use of approximately a 5 nm Ta spacer, and since both use an identical structuring of an AFM/fixed/Cu/free/Ta/fixed/AFM2 structure, both layer structures must inherently have similar properties. It is appreciated that the applicant is specifically utilizing the orange peel ferromagnetic coupling, whereas Lin '475 does not recognize the ferromagnetic coupling across the Ta layer. Nevertheless, in a product claim, it is the material structure, and not the recognition of a property of that structure, that define patentability.

Section 2112 of the MPEP supports the rejections applied in the prior office actions, and the lack of a need for Lin '475 to explicitly express the ferromagnetic coupling properties, by stating, 'The claiming of a new use, new function or unknown property which is inherently present in the prior art does not necessarily make the claim patentable. In re Best, 562 F.2d 1252, 1254, 195 USPQ 430, 433 (CCPA 1977). See also MPEP § 2112.01 with regard to inherency and product-by-process claims and MPEP § 2141.02 with regard to inherency and rejections under 35 U.S.C. 103,' and also 'Where applicant claims a composition in terms of a function, property or characteristic and the composition of the prior art is the same as that of the claim but the function is not explicitly disclosed by the reference, the examiner may make a rejection under both 35 U.S.C. 102 and 103, expressed as a 102/103 rejection. "There is nothing inconsistent in concurrent rejections for obviousness under 35 U.S.C. 103 and for anticipation under 35 U.S.C. 102." In re Best, 562 F.2d 1252, 1255 n.4, 195 USPQ 430, 433 n.4 (CCPA 1977). This same rationale should also apply to product, apparatus, and process claims claimed in terms of function, property or characteristic. Therefore, a 35 U.S.C. 102/103 rejection is appropriate for these types of claims as well as for composition claims.'

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO

MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer M. Dolan
Examiner
Art Unit 2813

jmd